Letter from the Chair

*Eric Brewe, Drexel University*

One of the real joys of serving as Chair of the FEd is the day that the awards are announced. FEd is in charge of several awards each year. The Excellence in Undergraduate Education award is given to a person or group that "have exhibited a sustained commitment to excellence in physics education." The Jonathan F. Reichert and Barbara Wolff-Reichert Award for Excellence in Advanced Laboratory Instruction Award recognizes and honors outstanding achievement in teaching, sustaining (for at least four years), and enhancing an advanced undergraduate laboratory course or courses at US institutions. And of course there is fellowship.

The joy that comes from the awards is really two parts, first and foremost is that the APS is recognizing members who have exhibited the hard work, innovation, and commitment to improving physics education. The second part is that the announcements mark the successful conclusion of a season of nominations, reviews, and approvals by a group of dedicated volunteers and the ever professional APS Staff. Nominating a person or a group for an award is not particularly difficult, and in many ways it is fun. Serving on a review committee is interesting, as often you would rather give awards to most every nomination that comes in - there is so much good work happening! I would like to acknowledge the efforts from three people that are instrumental in the awards: Catherine Crouch, Past Chair and Chair of the Awards Committee who made the awards happen this year. Daniel Claes, Vice Chair of FEd who stepped in to lead the review process this year as APS separated the solicitation of nominations and the review of nominations. Clausell Mathais, Graduate Student Representative, led the selection of the Excellence in Education Award.

The Excellence in Education Award this year is awarded to the Partnership for Integrating Computation into Undergraduate Curriculum (PICUP), "For developing an active, inclusive, and supportive community of physics educators dedicated to integrating computation into their instruction; creating, reviewing, and disseminating instructional materials; and generating knowledge of computation in physics curricula and of effective practices." The PICUP will be invited to present in an awards session at the April meeting in 2023.

This year’s Jonathan F. Reichert and Barbara Wolff-Reichert Award for Excellence in Advanced Laboratory Instruction Award was awarded to Laura Clarke of North Carolina State University, "For leadership and dedicated efforts in developing sustainable laboratory experiences and courses throughout the entire physics curriculum that address the needs of diverse students who are considering careers in both industry and graduate study."

In addition, FEd had six Fellowships awarded during 2022.

*Alfonso M. Albano, Bryn Mawr College*

Citation: For outstanding physics teaching, superb mentoring of hundreds of women physics undergraduates and dozens of graduate students, and innovative authorship of educational materials.

Chair continued on page 2
FEd Sessions at the March and April Meetings

Susan Blessing, Florida State University

I hope you’re planning to attend some (or all!) of the FEd sessions at the March or April Meetings in 2023!

At the March Meeting, FEd is sponsoring two invited sessions: The first is on Research Mentoring in Undergraduate and Graduate Programs and the second is on Computing in Physics Education.

We are also hosting two invited/contributed (Focus) sessions in March. One is to honor Laura Clarke of North Carolina State University who received the Jonathan F. Reichert and Barbara Wolff-Reichert Award for Excellence in Advanced Laboratory Instruction “for leadership and dedicated efforts in developing sustainable laboratory experiences and courses throughout the entire physics curriculum that address the needs of diverse students who are considering careers in both industry and graduate study.”

The second Focus session is to honor Rae Anderson of the University of San Diego who received the Prize for a Faculty Member for Research in an Undergraduate Institution “for outstanding contributions and innovative approaches to fundamental understanding of biopolymer composite dynamics and highly impactful research opportunities and physics training to a diverse set of undergraduate students.”

For the April Meeting, we are planning invited sessions on Broadening Participation in Nuclear Physics (jointly with DNP), Teaching Quantum Mechanics, and Beyond the Textbook, along with a session honoring the Excellence in Physics Education Award recipients (the PICUP Partnership), and a session organized by AAPT. There’s still plenty of time to submit abstracts for the April Meeting. Remember that you can give both a technical talk and a non-technical (e.g., education-related) presentation at the same meeting. We’re especially interested in learning about new or innovative courses or programs you’ve developed, which is a new sorting category this year, along with Laboratories.

I’m looking forward to an interesting and informative series of presentations that will help all of us improve our efforts to educate physics students and help them succeed – thanks to the work of the FEd Program Committee: Danny Caballero, Geraldine Cochran, Melissa Eblen-Zayas, Gina Passante, Idaykis Rodriguez, and Charles Ramey.
Creating Engaging, Memorable, Powerful Physics Communication

Katie Yurkewicz, Argonne National Laboratory

When someone says the phrase “science communication”, what immediately comes to mind? Is it talking to a journalist? Speaking to students at an outreach event? A Twitter thread or TikTok?

For many scientists, the phrase has outreach connotations. It’s about reaching non-scientists in effective and engaging ways for various purposes: educating them about a topic; inspiring them to learn more or explore a science career; or motivating them to support science funding. But the need for great communication within the world of science is also receiving increasing attention.

The good news? The same techniques used to craft powerful communication to non-scientists can also be applied to creating more effective communications in support of your career. Skills needed to create a memorable op-ed can also be used to produce a strong proposal narrative. Tools used to improve your public lectures can also result in more engaging presentations at an APS meeting.

The following three steps will help you create engaging, memorable, powerful physics communication, whether you’re giving a presentation at a departmental review or developing your next science video for YouTube.

Start by identifying your goal and audience
A common mistake I’ve encountered across two decades in communications is not starting a project with a clearly defined goal. People sometimes begin by choosing a vehicle (event, video, comic book) when instead they should start by thinking through exactly what they want to accomplish, and who they need to reach to make that happen. Even in scientific settings, where the type of communication is often defined for you (proposal, report, presentation), defining your goal is still valuable. Generic goals include education, inspiration, changing a behavior, or spurring a particular action. Exact goals can be much more specific, such as “getting 50 high school students living within a 30-mile radius to sign up for my STEM summer internship within one month.”

Once you have your goal, you can move on to defining the audience for your communication. Who do you need to reach to achieve your goal? Is it one particular person, a small group, or a whole demographic? Do they live in a specific geographic area, hold a certain elected position, or work in a particular job in a business sector? The clearer you can be about the specific people you need to reach, the better you can tailor the communication to achieve your goal.

Once you have your goal and audience defined, it’s time to move on to tactics. These are the communication vehicles best suited to reach your audience and achieve your goal. This could be anything from a short email to one person, or a virtual day-long STEM outreach event reaching thousands.

Capture and connect with your audience
To achieve your goal with any communication, you need to grab your audience right from the beginning, and keep their attention through to the end. The amount of time you have to capture an audience’s attention ranges—but not by nearly as much as you might think. In the digital realm, you have as little as 1-2 seconds to grab someone’s before they scroll by or navigate away from your content [1,2]. In person, you only have 1 or 2 minutes to convince your audience to focus on what you have to say. Some tried and true methods for capturing an audience’s attention are asking a question, giving a startling statistic, asking the audience to imagine something, or giving a “what if” scenario. Enthusiasm and excitement are also catching – if you’re visibly or audibly excited about your subject, chances are your audience will be too.

Capturing your audience’s attention is just the start: building a connection with your audience is vital for memorable communication.

The good news? As a scientist, you’re already starting from a good foundation of trust with the public. Surveys conducted by the Pew Research Center [3,4] and collected by the National Science Board [5] have shown consistently strong support for science and scientists, despite small dips as a result of the COVID-19 pandemic. For example, more than 80% of surveyed adults agree that the government should fund basic scientific research, and that investments in science are usually worthwhile. Almost 80% of Americans have at least a fair amount of confidence in science and scientists, despite small dips as a result of the COVID-19 pandemic. For example, more than 80% of surveyed adults agree that the government should fund basic scientific research, and that investments in science are usually worthwhile. Almost 80% of Americans have at least a fair amount of confidence in scientists to act in the best interest of the public (compared with 40% for journalists and 24% for elected officials).

You can build on that basic foundation of trust using various techniques. Demonstrate your expertise by stating your degrees and credentials. Establish common interests by sharing details from your background, hobbies, or life experiences that may combat a common audience misperception that “scientists are nothing like me.” Be honest and open: share failures you’ve experienced along your scientific path, be transparent about the potential societal applications of your work – or lack thereof.

Tell engaging stories
Now comes the final challenge: getting your messages across in a way that will engage your audience to achieve your goal. Here, scientists have it harder than politicians. Surveys have shown that fewer than 20% of US adults are active science news
consumers, only about 25% can adequately describe a scientific study, and over 70% don’t believe that general news sources get the facts right most of the time [6,7,8].

Storytelling is a tried and true method for communicating complex information in a way that audiences are primed to understand. Human brains are wired to understand and remember stories, and we have been telling them to each other for thousands of years.

Telling great stories takes planning and practice. As science storytelling has grown in popularity and interest, a variety of online resources have cropped up to help you learn and practice how to tell good stories. Google “science storytelling” and you’ll find links to everything from scholarly journal articles to YouTube masterclasses to companies offering science storytelling services.

To try science storytelling on your own, start with the four elements of a great story: the character; their goal; the challenge they have to overcome; and the resolution. And don’t hesitate to bring the creativity. For the character, it’s easy to choose yourself or another scientist, but it could also be a research group, piece of equipment, or even something under study like a material or a particle. The goal could be to solve a problem, make a discovery, or reach a destination. And the challenge could be a lack of progress, lack of resources, diversion, or disagreement. And resolution doesn’t always mean success – it could just as easily be failure (just make sure to end on a note of hope for the future). And above all, remember that a memorable story needs to be understandable to your audience, so be sure to jettison the jargon.

The next time you're faced with a new communication opportunity – whether it's within the science community, or to the public—consider adapting one or more of these techniques to ensure that your communication is engaging, memorable, and powerful.

References
Section on Teacher Preparation

Alma Robinson, Virginia Tech

The American Association for Employment in Education (AAEE) conducts an annual survey to determine trends in educator supply and demand across the United States. In this issue of the Teacher Preparation Section, Tim Neubert, the Executive Director of AAEE highlights the consistent trend of the United States having a considerable shortage of physics teachers and provides data that may be helpful when advocating for physics teacher preparation programs.

Jason Sullivan, Fernand Brunschwig, and Yadana Nath Desmond describe the STEMteachersNYC Community Learning Network. These networks combine the strengths of STEM education programs and preservice teachers with the experience of seasoned teachers and provide opportunities for mentorship and professional development for teachers at every stage of their career.

Physics Teachers in K-12 Education: A History of Schools Doing Without

Tim Neubert, Executive Director, American Association for Employment in Education

“Wilson County High School Won’t Offer Physics Course Due to Teacher Shortage,” WSMV, July 20, 2022
“Students, Parents: There’s No Teacher Teaching AP Physics,” Montclair Local News, February 12, 2020
“Plan to Expose All Students to Physics Missing One Element – Teachers,” EdSource, July 23, 2019

News headlines continue to reiterate what the American Association for Employment in Education has known for some time: The supply of physics teachers within K-12 is in considerable shortage.

In our most recent Educator Supply and Demand Report (2021-2022), colleges, universities, and school systems across the United States rank teacher shortages in different subject fields on a 5-point scale, where 1.00 indicates considerable surplus and 5.00 indicates considerable shortages. The average number assigned by responding colleges and universities for physics teachers was 4.44. Meanwhile, the average number assigned by responding School Systems for physics teachers was 4.56. Anything above 4.21 is classified as "Considerable Shortage". In other words, both those who train and prepare educators and those who recruit and retain them agree: The United States continues to experience a considerable shortage of physics teachers.

Sixty-three percent of colleges and universities responding to this year’s survey indicated they offered degree or certification programs in physics. This percentage of respondents with such programs has remained mostly unchanged during recent years, varying between 56% and 65% in the past six years. Meanwhile, the mean number of students expected to graduate from responding institutions during the 2021-2022 academic year with a degree in physics was just seven. This number has remained in the single digits during the past six years, varying between four and nine.

Physics is considered a K-12 teaching area where the perceived demand for graduates is high, but the percent of institutions offering degrees in physics is medium. This situation has existed for at least ten years.

According to AAEE’s Educator Supply and Demand Report, physics teachers in K-12 schools is a "considerable shortage" area in eight out of ten regions of the country (West, Rocky Mountain, Great Plains/Midwest, South Central, Southeast, Great Lakes, Middle Atlantic, and Alaska). The Northwest and the Northeast still deem physics to only have "some shortage.”

When asked to suggest the best way to attract high school students to study education in college, the top answers from responding colleges and universities were high school to college teacher programs, compensation incentives, and inspiration from highly regarded teachers. Responding school systems agreed, while also suggesting conversations between high school students and their teachers who lead by example.

How might you encourage and support the next generation of Physics teachers, and perhaps finally end the long-standing trend of a considerable shortage of Physics teachers within K-12?

Tim Neubert is Executive Director for the American Association for Employment in Education, a national non-profit association based in Illinois and focused on positively impacting education through professional connections. Prior to joining AAEE in January 2018, Tim served nearly 20 years in human resources roles for PK-12 school districts in Illinois. Tim has earned a Bachelor’s in Business Ethics and a Master’s in Human Resources Management.
Community Learning Network - Newly Planted SEEDS

Jason Sullivan, Montgomery Township School District
Fernand Brunschwig, STEMteachersNYC
Yadana Nath Desmond, STEMteachersNYC

The STEMteachersNYC Pre-Service Project

One of the most critical areas of need in STEM Education is access to high-quality teacher professional learning for both practicing and aspiring educators. Historically, professional learning has been structured such that these two groups, practicing and aspiring teachers, rarely participate in collaborative learning opportunities. Furthermore, training and retention of educators continues to present a significant challenge and is amplified in communities traditionally underrepresented in education.

At STEMteachersNYC we believe that new teachers can be set up for success in their first years by inviting them into the professional community before their first day in the classroom. STEMteachersNYC has always offered workshop admission at little or no cost to pre-service teachers. This past year we began offering professional development workshops for STEM teachers and Brooklyn College Graduate and Undergraduate Pre-service teachers, on campus and virtually. Facilitated by STEMteachersNYC leadership, workshop leaders, and a Pre-Service Project Coordinator, STEMteachersNYC programs offered customized packages of workshops for credit, aligned to college course requirements and degree focus, offering additional support for Brooklyn College participants. This unique approach positioned pre-service educators next to experienced educators to collaborate around critical pedagogical, curricular, and equity issues.

One pre-service educator shared, "It was great being able to meet and talk with experienced teachers who are so open about sharing their advice and challenges with one another and motivate each other through the journey. As a pre-service teacher, I didn't know what to expect from this career and was having many doubts and unanswered questions, but the workshop introduced me to many realistic and effective classroom practices. Not only that, it taught me how to think like a student once again through hands-on activities that promote inquiry-based learning and critical thinking while being very engaging." Nathalie K. – Pre-Service Teacher/Student at Brooklyn College.

STEMteachersNYC Community Learning Network

Our partnership with Brooklyn College’s Department of Secondary Education launches our Community Learning Network (CLN) with the first of five NYC Borough hubs, that will each aim to weave together degree programs that prepare teachers for the classrooms, experienced teacher expertise through the STEMteachersNYC professional learning community, and new pathways for teacher development and leadership, to create an integrated pathway of professional learning synergized by the strengths of experienced and pre-service educators. By spanning the continuum of the teaching profession, we aim to integrate the strengths of a leading teacher-training institution (Brooklyn College) with our in-service professional learning and peer leadership development. STEMteachersNYC CLN hubs will serve as conduits for pre-service and new teachers to gain insight into the realities of the classroom through the eyes of seasoned teachers with diverse experiences and strategies. Overtime, the CLN hubs will provide a sustainable professional learning and mentorship forum with the intention of growing and retaining high quality educators. With the help of partners like Siegel Family Endowment and Beyond100K, the CLN hubs will support educators who reflect and represent their students and cultivate professional learning opportunities that create conditions for all students to thrive in STEM learning.

STEM Lab & our Community Learning Network hubs

The journey toward building CLN hubs has already begun. STEMteachersNYC workshops have welcomed Brooklyn College preservice educators and initial collaborations have been positive. Last year, workshops joined together experienced educators with a passion for STEM learning and aspiring teachers. The expertise of the educators allowed aspiring teachers to experience best practices in STEM education, and the perspective of the aspiring teachers offered opportunities for experienced educators to better understand issues of equity and inclusion facing youth and adults just entering the field of education. For example, a workshop focusing on primary grade STEM education worked on developing meaningful phenomena that engaged learners in culturally responsive contexts. A preservice workshop participant was able to offer an ecology prompt based on agricultural practices connected communities from Central America. The preservice educator provided a context that represents many of the children in their classroom and the experienced educators were able to help refine the lesson to support student inquiry and best pedagogical practices. Previously, this type of collaboration was infrequent and opportunities to influence aspiring teacher practice rare.

The Kid Talk Teacher Talk STEM Lab framework, developed by Amy Wish and Jason Sullivan over three years and supported by a grant from 100Kin10, offers participants a unique opportunity to not only collaborate with peers on new material, but to implement this material with students during the course of...
the professional learning workshop, as well as iterate through a
debrief and mini ‘lesson study’. Each hub will establish its own
STEM Lab school partner to move this invaluable and unique
professional learning experience forward for in-service and pre-
service teachers.

STEMteachersNYC is grounded in the motto of professional
learning for teachers by teachers. Across the many workshops,
the conversations between aspiring and experienced teachers
were rich, challenging, and affirming of the need for CLN hubs
and the emerging opportunities for future collaborations.

**Physics Teaching Initiatives at STEMteachersNYC in 2021-2022**

Our roots in the work of Robert Karplus continued to nurture the
joy of discovery in physics teaching in 2021-22. President Fern-
nand Brunschwig’s work with Karplus at Berkeley provided the
experience with physics teaching creativity that animates our
physics teaching workshops. A celebration of Robert Karplus’
95th birthday, planned and conducted in collaboration with the
Karplus Family, attracted a group of over 50 physicists, teach-
ers and researchers from around the world. A series of working
group sessions led by David Rakestraw of the Lawrence Liver-
more Lab and overseen by Elissa Dunn Levy cultivated interest
in using the cell phone as a measurement tool, culminating
in an extraordinary intensive weekend workshop putting into
practice a variety of genuinely new ideas that had been nurtured
by the group and brought to full flower by Rakestraw.

We developed and delivered 5 workshops on various aspects
of Quantum Physics and Quantum Computing in 2021-22, at-
tracting registrations from a total of 184 teachers interested in
learning about this increasingly important topic which we are
in the vanguard of efforts to introduce as a vital part of the stan-
dard curriculum. Experienced workshop leaders Elissa Dunn
Levy, Zhanna Glazenburg and Fernand Brunschwig guided grad-
uate students Anna Ciociou, Claire Warner, Aaron Holman and
Philip Weiss in designing and presenting the workshops, which
attracted high ratings on both content and pedagogy. Another
outstanding result of our focus on innovation has been our new
Quantum Operators, the product of intensive collaboration be-
tween President Fernand Brunschwig and Chief Innovation Of-
cifer Mark Schober. Based upon work by Costas Papaliolios at
Harvard in the 1950s and 60s, these new teaching devices uti-
lize the analogy between polarization of light and the electron
spin as two-state quantum systems to teach the key principles
via hands-on experience. The Quantum Operators are now
available at etsy.com/shop/stemteachersnyc.

**Jason Sullivan** earned an undergraduate degree in chemistry and imme-
diately entered the field of education as a middle school science and math
teacher. After 7 years and a move from Michigan to New Jersey, he joined
Montgomery HS where he first served as a physics and chemistry teacher tak-
ing over as the MHS Science Department Supervisor, a position he has held
for the past 17 years. Jason first connected with the STEMteachersNYC com-
munity through Modeling Physics Instruction workshops and was fortunate
to be among the first of STEMteachersNYC to engage in the Elementary STEM
Initiative.

**Fernand Brunschwig** studied physics and science education at Harvard
(AB, 1964; MAT, 1965) and at Berkeley, earning an MS in physics in 1970 and
a PhD in Science Education in 1972 with Robert Karplus. He was a founder
of SUNY Empire State College, retiring after 40 years in 2012. Brunschwig
helped found STEMteachersNYC in 2011, and as the first President he has
been instrumental in its notable growth and success in providing high-
quality professional development to PreK-12 STEM teachers in the NYC Area
and beyond.

**Yadana Nath Desmond** studied Biology (BA) at Baruch College, Plant Chem-
istry (MSc) at Leiden University, and International Education Policy and
Planning (EdM) at Teachers College. She has taught K-16 science in formal
and informal settings, supported a network of science teachers in Thailand,
conducted Ethnobotanical research in Palau, contributed to Engineering
coursework at The Cooper Union, and was the first education program man-
ger at NYCSI. Now Executive Director at STEMteachersNYC, she is continu-
ally inspired by the creativity and professionalism of the teachers she works
with, and tirelessly develops opportunities, partnerships, and programs that
support our STEM teacher community and all the ways our teachers seek to
grow.
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**Upcoming newsletter deadlines:**

Spring 2023: January 15, 2023
Summer 2023: June 1, 2023